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From transpression to trnstension along the west Barents margin: the Forlandsundet basin, W. Svalbard

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The enigmatic and understudied Forlandsundet Basin in western Svalbard represents the outermost onshore Cenozoic basin along the NE Atlantic margin. It occupies a key location to understand the margin′s tectono-sedimentary history as the margin switched from transpression to transtension in the late Paleogene. During Paleocene and Eocene time, the Barents segment of the NE Atlantic margin accommodated dextral shear between Svalbard and Greenland resulting in the formation of a transpressional orogen and associated foreland basin in western Spitsbergen. At anomaly 13 time (c. 33Ma), re-arrangement of the spreading system in the North Atlantic included formation of the obliquely ultraslow-spreading Knipovitch Ridge west of Spitsbergen. Ridge formation was preceded by a very dramatic reduction of crustal thickness west of Spitsbergen. The Forlandsundet Graben structure sits at the shoulder of a very narrow necking domain developed along parts of the sheared margin, where continental crust was thinned to a few kilometers or less over c. 100 km horizontal distance. The basin geometry is that of an asymmetric graben to half-graben filled with coarse continental-derived siliciclastics and finer-grained marine sediments. Parts of the outcropping stratigraphy represent continental-derived conglomeratic debris flows deposited into the marine environment. The basin is poorly dated but ages ranging from the Eocene to Early/Late Oligocene have been proposed by previous workers based on fossils and strontium isotope data. The basin is bound by normal/oblique faults that truncate the Paleocene-Eocene W. Spitsbergen fold and thrust belt, which may favor the Oligocene age. Both normal/oblique faults and contractional structures in the form of folds and thrusts are documented. Large-scale folds are oriented at an oblique to high angle compared with structures in the fold and thrust belt, but approximate the NW-SE maximum elongation trend as recorded by a number of oblique-slip and normal faults. We interpret these observations to indicate that the Forlandsundet Basin mainly post-dates the transpressional foreland basin and its formation and subsequent deformation occurred under dextral transtension. At least parts of the folding and thrusting recorded in the basin likely represents a response to orthogonal shortening associated with transtension. At this point it has not been proven that shortening was coeval with basin sedimentation, but syn-sedimentary extension and orthogonal shortening have been documented from transtensional basins elsewhere. We report new data from the Forlandsundet Basin and propose that it may represent an excellent analogue to basins deposited elsewhere along the W Barents Sea margin.